ADSP HW5

Two Real DFT In One DFT

f = x + iy

x = (f+fx)/2

y = (f-fx)/2i

X = (F+Fx)/2

Y = (F-Fx)/2i

Install Environment

```
pip install numpy argparse matplotlib
```

Run the Code

```
python main.py # default
```

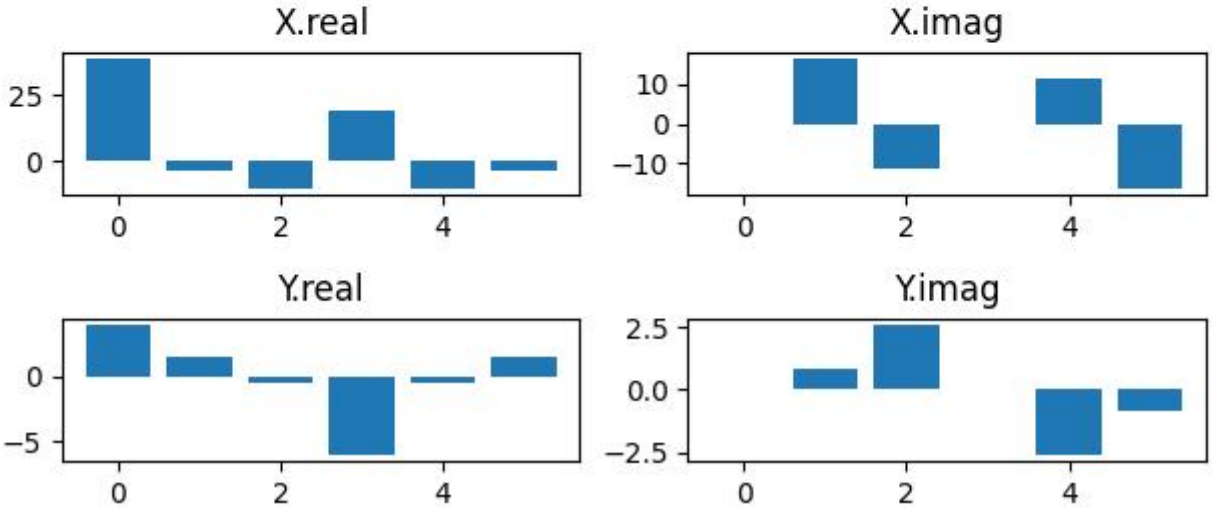
```
python main.py {--x list of real number} {--y list of real number}
```

```
python main.py --x 5 3 4 1 20 6 --y 0 1 0 1 -1 3
```

Results

Implement two real DFT in one DFT

```
x: [ 5.  3.  4.  1. 20.  6.]
y: [ 0.  1.  0.  1. -1.  3.]
X: [ 39.  +0.j      -3.5+16.454483j -10.5-11.25833j   19.  +0.j
  -10.5+11.25833j   -3.5-16.454483j]
Y: [ 4. +0.j      1.5+0.866025j -0.5+2.598076j -6. -0.j
  -0.5-2.598076j  1.5-0.866025j]
```



Compare one DFT with two DFT:

```
x:[ 5.  3.  4.  1. 20.  6.]
y:[ 0.  1.  0.  1. -1.  3.]

f:[ 5.+0.j  3.+1.j  4.+0.j  1.+1.j 20.-1.j  6.+3.j]
F:[ 39.       +4.j        -4.366025+17.954483j -13.098076-11.75833j
  19.       -6.j        -7.901924+10.75833j   -2.633975-14.954483j]
Fx:[ 39.       -4.j        -4.366025-17.954483j -13.098076+11.75833j
  19.       +6.j        -7.901924-10.75833j   -2.633975+14.954483j]

One DFT:
X with one DFT:[ 39.  +0.j        -3.5+16.454483j -10.5-11.25833j   19.  +0.j
 -10.5+11.25833j   -3.5-16.454483j]
Y with one DFT:[ 4. +0.j        1.5+0.866025j -0.5+2.598076j -6. -0.j
 -0.5-2.598076j  1.5-0.866025j]

Two DFT:
X with np DFT:[ 39.  +0.j        -3.5+16.454483j -10.5-11.25833j   19.  -0.j
 -10.5+11.25833j   -3.5-16.454483j]
Y with np DFT:[ 4. +0.j        1.5+0.866025j -0.5+2.598076j -6. -0.j
 -0.5-2.598076j  1.5-0.866025j]

IDFT(X):[ 5.+0.j  3.-0.j  4.+0.j  1.+0.j 20.-0.j  6.+0.j]
IDFT(Y):[ 0.+0.j  1.+0.j  0.-0.j  1.+0.j -1.+0.j  3.-0.j]

Is X correct: [ True  True  True  True  True  True]
Is Y correct: [ True  True  True  True  True  True]
```